Cognitive and personality correlates of trait disgust and their relationship to condemnation of non-purity moral transgressions

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Abstract
Past research has found that individuals who are more sensitive to physically disgusting stimuli also condemn moral transgressions more harshly. However, there is debate about whether this condemnation includes transgressions that do not involve impure behaviors. We present a meta-analysis of six studies (N = 1082) which suggests that trait disgust is associated with condemnation of non-purity transgressions. This relationship was primarily explained by sensitivity toward the very core disgust stimuli that those transgressions lack. We next tested whether this relationship might be mediated by a third variable. We found that trait core disgust was associated with higher orderliness, lower deviance sensitivity and preference for intuitive thinking; these variables also correlated with moral condemnation. Trait disgust was also associated with lower generalized social trust, but trust was not correlated with moral condemnation. Neither trait disgust nor moral condemnation were associated with ethnocentrism. Further, none of these variables mediated the relationship between trait disgust and condemnation. Taken together, our results support a role for trait disgust in moral judgments outside of the purity domain, but leave unexplained its association with condemnation of non-purity transgressions.

Keywords: Disgust sensitivity, moral judgment, conscientiousness, intuitive thinking, deviance
The primary function of disgust is to help us avoid disease by serving as a behavioral extension of the immune system: avoiding disgusting objects prevents contact with pathogens and saves costly effort from the physical immune system (Curtis, De Barra, & Auinger, 2011; Oaten, Stevenson, & Case, 2009; Rozin & Fallon, 1987; Schaller & Park, 2011). Accordingly, disgust is elicited by potentially contaminating stimuli, such as body products, spoiled food, wounds, certain invertebrate animals, and death (Haidt, McCauley, & Rozin, 1994).

Interestingly, moral transgressions also elicit disgust; for example, theft, murder and unfair behavior are all described as “disgusting” (Haidt et al., 1994; Hutcherson & Gross 2011; for review, see Chapman & Anderson, 2013). However, there is debate about whether disgust’s role in morality is limited to certain kinds of transgressions. Whereas some have suggested that disgust is only associated with moral transgressions that violate norms of bodily purity (e.g. “inappropriate” sex, food taboos, hygiene; Haidt & Graham, 2007; Horberg, Oveis, Keltner, & Cohen, 2009; Rozin, Lowery, Imada, & Haidt, 1999; Russell & Giner-Sorolla, 2013), others have argued that disgust is also associated with non-purity transgressions that do not involve bodily purity norms, such as stealing and physical harm (Chapman & Anderson, 2013; Jones & Fitness, 2008; Hutcherson & Gross, 2011; Cameron, Lindquist, & Gray, 2015).

One piece of evidence in this debate is the relationship between individual differences in the tendency to experience disgust toward physical stimuli – known as trait physical disgust, or simply trait disgust – and the tendency to condemn moral transgressions. On one hand, some have argued that increased trait disgust is only associated with increased condemnation of purity transgressions (Horberg et al., 2009; Inbar, Pizarro, Knobe, & Bloom, 2009). For instance, Inbar, Pizarro and Bloom (2009) found an association between trait disgust and conservative attitudes toward purity issues such as abortion and homosexuality, but no association between
conservative attitudes toward non-purity issues such as gun control, labor unions or welfare. Further, Horberg and colleagues (2009) found an association between trait disgust and judgments of pure and impure behaviors, but not judgments of unjust or harmful behaviors. Also, the widely cited Moral Foundations Theory (Haidt & Graham, 2007), and the CAD Triad Hypothesis (Rozin et al., 1999) that it is built upon, connect disgust with violations of purity and divinity, and anger with violations of autonomy and fairness.

On the other hand, and contrary to the idea that disgust’s role in morality is limited to the purity domain, recent work has shown that higher trait disgust is also associated with increased condemnation of non-purity transgressions such as physical harm (Chapman & Anderson, 2014; Jones & Fitness, 2008). Furthermore, using the Three Domain Disgust Scale (TDDS; Tybur, Lieberman, & Griskevicius, 2009), van Leeuwen, Dukes, Tybur and Park (2017) found an association between trait disgust and the ingroup/loyalty and authority/respect moral foundations, suggesting that trait disgust is associated with morality outside of the purity domain. However, they did not find a relationship with the harm/care and fairness/reciprocity foundations that also fall outside of the purity domain. Further, supporting the idea that trait disgust influences condemnation of non-purity-transgressions, the pathogen and moral disgust subscales of the TDDS are correlated at $r = .20$ (Tybur et al., 2009).

In sum, there is still controversy about whether trait disgust only influences condemnation of purity transgressions, or also the condemnation of non-purity transgressions. We aim to address this controversy by meta-analyzing several published and unpublished studies from our lab on trait disgust and condemnation of non-purity transgressions.

If trait disgust is indeed related to condemnation of non-purity transgressions, the obvious next question is why this relationship exists. At face value, it is quite surprising that the influence
of trait disgust extends to condemnation of transgressions that do not involve physical disgust stimuli. For example, there is no evident reason why being disgusted by maggots or vomit would be related to condemning physical violence. A second aim of the current research was therefore to test potential mechanisms through which trait disgust might influence condemnation of non-purity transgressions.

One possible explanation for this relationship is that it may be mediated by state emotion. According to this view, high trait disgust predisposes an individual to feel disgusted when encountering a transgression; this state disgust would then cause harsher moral condemnation (Haidt, 2001). However, a recent meta-analysis suggests that incidental inductions of state disgust do not reliably cause harsher moral condemnation (Landy & Goodwin, 2015). Additionally, it is difficult to see why transgressions that involve no physical disgust elicitors would evoke state disgust in the first place.

An alternative to emotional mediation is that the relationship between trait disgust and condemnation of non-purity transgressions may be an artifact of correlations between trait disgust and some other variable. For example, Russell and Giner-Sorolla (2013) have noted that moral disgust is often highly correlated with anger, which is a more prototypical moral emotion than disgust. If trait anger and trait disgust are correlated, then it could be trait anger rather than disgust that drives the apparent relationship between disgust and condemnation. However, several studies have found that higher trait disgust is related to increased condemnation even when controlling for trait anger (Chapman & Anderson, 2014; Jones & Fitness, 2008). Another possible explanation for the link between trait disgust and condemnation of non-purity transgressions is social conservatism, since conservatism is positively correlated with trait disgust (Terrizzi, Shook, & McDaniel, 2013). However, past research has shown that the
relationship between trait disgust and condemnation persists even when social conservatism is statistically controlled (Chapman & Anderson, 2014).

In summary, it is currently not clear why individual differences in trait disgust would predict condemnation of non-purity transgressions. The current research tested whether trait disgust may influence other cognitive or personality processes, which in turn influence moral condemnation – thus mediating the relationship between trait disgust and moral condemnation. We tested five potential mediators: orderliness, deviance sensitivity, cognitive thinking style, generalized social trust, and ingroup affiliation.

**Orderliness, trait disgust and moral condemnation**

The first variable that may be related to trait disgust and mediate its relationship with condemnation of non-purity transgressions is orderliness, an aspect of conscientiousness. It has been proposed that each of the Big Five personality traits can be broken down into two aspects that represent distinct but correlated manifestations of the trait (DeYoung, Quilty, Peterson, 2007). In this approach, conscientiousness is broken down into industriousness and orderliness. While the industriousness aspect of conscientiousness reflects one’s tendency to get things done, orderliness reflects one’s preference for order, tidiness, rules, routine and detail (DeYoung et al., 2007). Previous studies have found an association between conscientiousness and trait disgust (Druschel & Sherman, 1999; Tybur & de Vries, 2013), but it is noteworthy that in these studies conscientiousness was not broken down to orderliness and industriousness. We propose that orderliness in particular is related to trait disgust, because orderliness may act as a disease avoidance strategy. This could work in two ways. First, keeping physical order helps to prevent bacterial growth and pest infestation, and makes it easier to notice potentially contaminating rodents and insects. Second, keeping social order by seeing that rules are followed and that
people act in an orderly fashion can prevent other members of the group from catching infections, or threatening the social norms that serve to protect the ingroup from contamination (Terrizzi, Clay, & Shook, 2013).

A preference for order and rules, related to trait disgust, may have consequences for moral condemnation. Moral rules are important for maintaining social order, and people who generally see order and rules as important may also be more condemning of those who act against them. Accordingly, higher trait disgust may be related to increased moral condemnation because of the relationship between trait disgust and orderliness.

Deviance sensitivity, trait disgust and moral condemnation

A second variable that could mediate the relationship between trait disgust and condemnation is sensitivity to deviance. Disgust protects us from contamination, and a major source of pathogens is other people: those who are sick and those who may carry novel pathogens (i.e. strangers). To identify and avoid such people, humans have developed a sensitivity to cues of potential contamination and deviance in people, such as lesions, disfigurements and other morphological abnormalities, as well as an appearance that deviates from one’s ingroup (Faulkner, Schaller, Park, & Duncan, 2004; Kurzban, & Leary, 2001). Human history is rife with examples of avoiding deviant individuals, such as lepers, immigrants or the mentally ill, and individual differences in trait disgust as well as priming disgust predict negative outgroup attitudes (e.g. Hodson & Costello, 2007; Inbar, Pizarro, & Bloom, 2012). Deviant appearance also serves as a cue for contamination outside the social domain: for instance, discoloration, disfiguration or an abnormal texture can signal that a food may be spoiled.
Since deviant appearance in the physical world can indicate contamination, it is possible that people who are more sensitive to cues of contamination (i.e., higher in trait disgust) are also more sensitive to cues of deviance in general. That is, those higher in trait disgust may be more likely to make a cognitive judgment that a target has deviated from the norm. It is possible that this general tendency to perceive non-social deviance extends into the socio-moral domain, and this could explain why trait disgust influences condemnation of moral transgressions even when no physical disgust elicitors are present. To morally condemn something, one must first perceive that an individual has deviated from a norm or rule. Higher sensitivity to deviance may predispose an individual to perceive this deviation as larger, and as a result condemn it more harshly.

Sensitivity to non-social deviance has been assessed using a shape classification task in which participants judge whether imperfect geometrical shapes (e.g. a misshapen triangle) are examples of the prototype shape (e.g. a triangle; Figure 1). Consistent with a link between non-social deviance sensitivity and socio-moral judgment, higher deviance sensitivity has been shown to partially explain why conservatives endorse more severe punishments for criminals than liberals (Okimoto & Gromet, 2016). In other words, conservatives’ general tendency to perceive greater deviance may cause them to perceive criminals or their acts as more deviant and call for harsher punishments as a result. Similarly, greater deviance sensitivity may explain the greater condemnation of moral transgressions associated with trait disgust: those who are higher in trait disgust may perceive the transgressions to be more deviant, and consequently, more wrong.

Intuitive thinking, trait disgust and moral condemnation
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The third variable that could mediate the relationship between trait disgust and condemnation of non-purity transgressions is cognitive thinking style. According to dual-process models of cognition, people process information with two distinct but interacting cognitive systems: a quick and intuitive system and a slow and analytical system (De Neys, 2006; Epstein, 1994; Evans, 2003; Kahneman & Frederick, 2002; Pacini & Epstein, 1999; Sloman, 1996; Stanovich & West, 2000). The intuitive system is the default people rely on in everyday behavior, but one can also switch to the more effortful analytical system when motivated to do so (Shiloh, Shalton, & Sharabi, 2002). There are individual differences in this motivation, and people who gravitate towards a more intuitive thinking style rely more on heuristics (Epstein, Pacini, Denes Raj, & Heier, 1996; Shiloh et al., 2002; Toplak, West, & Stanovich, 2011), are more susceptible to biases (Epstein et al., 1996; Klaczynski, Gordon & Fauth, 1997; Toplak et al., 2011), are more religious (Gervais & Norenzayan, 2012; Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014b; Shenhav, Rand, & Greene, 2012) and believe more in the paranormal (Aarnio & Lindeman, 2005; Epstein et al., 1996; Wolfradt, Oubaid, Straube, Bischoff & Mischo, 1999). Individual differences in cognitive thinking style also have consequences for moral condemnation. For instance, greater analytical thinking is associated with having a less punitive attitude toward criminals (Pacini & Epstein, 1999), and with decreased condemnation of harmless purity transgressions (Pennycook, Cheynea, Barr, Koehler, & Fugelsang, 2014a). Additionally, people condemn incestuous behavior less when forced to reflect on a strong versus a weak argument in favor of it (Paxton, Ungar, & Greene, 2012). These studies focused on purity transgressions, but thinking style may also influence condemnation of non-purity transgressions. Someone with a stronger intuitive thinking tendency may be quick to judge a moral transgression as wrong, rather than to ponder
upon factors that could mitigate this judgment. In contrast, someone with a stronger analytical thinking tendency may stop to consider different explanations for the transgressor’s behavior, and what the social context of the transgression might be. This could then reduce moral condemnation, especially when there is little information available about what caused the transgression.

Intuitive thinking may also be related to trait disgust. Oaten and colleagues (2009) have pointed out that to function effectively as a disease avoidance mechanism, disgust has evolved to be relatively automatic and cognitively impenetrable. One piece of evidence for this proposal comes from the laws of sympathetic magic, which disgust has been shown to follow (Rozin, Millman, & Nemeroff, 1986). From these laws, the law of contagion holds that “once in contact, always in contact” – for example, people are reluctant to wear a sweater that once belonged to Hitler (Rozin et al., 1986). The law of similarity holds that “the image equals the object” – for instance, delicious chocolate fudge becomes undesirable once it is shaped like dog feces (Rozin et al., 1986). These two laws demonstrate how disgust is resistant to analytical reasoning: even though one knows that Hitler’s personality cannot be transmitted by wearing his sweater, or that fudge shaped like dog poo is still just fudge, the disgust reaction persists.

Additional evidence for the cognitive impenetrability of disgust comes from studies showing that disgust is more difficult to extinguish than fear (Olatunji, Forsyth, & Cherian, 2007), and that once disgust is triggered, its psychophysiological effects are not mitigated by learning that the supposed disgust elicitor is not actually contaminating (Hinds et al., 2010). For example, when participants touched ostensibly soiled diapers, their heart rate did not return to baseline when they were told that the diapers were not really soiled (Hinds et al., 2010). Because of disgust’s automatic nature and the potentially high cost of being contaminated, disgust is also
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prone to false alarms (Oaten et al., 2009; Tybur, Lieberman, Kurzban, & DeScioli, 2013). This is demonstrated for instance by prejudice toward otherwise healthy individuals with a non-contagious physical disability or disfigurement (Clarke, 1999), and the finding that physically disabled individuals are implicitly associated with disease (Park, Faulkner, & Schaller, 2003). Also in these cases, analytical knowledge of the non-contagious nature of these disease cues does not change the avoidant reaction towards them.

The automatic and cognitively impenetrable nature of disgust suggests that it is largely an intuitive process, which is resistant to the influence of analytical processes. It may then be that a susceptibility to disgust is associated with a susceptibility to intuitive thinking in general. In other words, individuals who have a strong tendency to be disgusted (i.e. who are high in trait disgust), may also be generally more intuitive in their cognitive judgments. Thus, people high in trait disgust could be more prone to intuitive thinking, which in turn could lead to harsher moral condemnation.

Generalized social trust, trait disgust and moral condemnation

The fourth potential mediator for the relationship between trait disgust and condemnation is generalized social trust. Generalized social trust is the willingness to trust others, including those we do not know (Putnam, 2000). It is the tendency to believe good of others – that they will not harm us, and that they will look after our interests if they can. Generalized social trust is different from the trust in close individuals such as friends and family; it is trust in people characterized with “weak social ties” – that is, people in one’s extended social network, such as in one’s neighborhood (Putnam, 2000; Uslaner, 2002). Past research suggests that trait disgust is negatively correlated with generalized social trust (Aarøe, Osmundsen, & Petersen, 2016). This inverse relationship may exist because individuals who are highly invested in pathogen
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avoidance are less likely to seek out cooperation with a broad circle of people, due to the pathogen transmission risks associated with such contact (Aarøe et al., 2016).

Generalized social trust may also influence moral condemnation. Classic studies on cooperative games suggest that low generalized social trust is associated with harsher punishments of non-cooperation (Yamagishi, 1986; 1988). Also, when asked to reflect on their behavior afterwards, individuals low in generalized social trust reported more eagerness to punish transgressors, and felt that those transgressors should be punished more severely (Yamagishi, 1988). Since individuals low in generalized social trust are actually more punishing of transgressors and more readily endorse sanctioning systems than individuals high in generalized social trust, it is reasonable to believe that they would also harshly condemn moral transgressors. Therefore, high trait disgust may be associated with low generalized social trust (from hereafter referred to only as “trust”), which in turn may mediate the relationship between trait disgust and moral condemnation.

*Ingroup affiliation, trait disgust and moral condemnation*

A final variable that could mediate the relationship between trait disgust and moral condemnation is ingroup affiliation. From an evolutionary perspective, threats that can be effectively addressed with social support should increase ingroup attraction and trigger the need to affiliate with one’s ingroup (Navarrete & Fessler, 2005). Threat of disease falls into this category: in times of illness and disease, the people in one’s ingroup (such as friends and family) would be the ones to come to aid. Consistent with this reasoning, Navarrete and Fessler (2006) found that perceived disease threat increased ethnocentric attitudes, and that both state and trait disgust increased in-group attraction – suggesting that transitory and chronic vigilance to pathogens bolster the need to affiliate with one’s ingroup.
According to the theory, a disease threat should not only push people to affiliate with their group, but also to bolster the values and norms of their ingroup (Navarrete & Fessler, 2006). Showing adherence to ingroup norms signals one’s commitment to the group, making others more willing to offer their help in times of adversity (Navarrete & Fessler, 2005). In line with this reasoning, we propose that being chronically vigilant toward pathogens – that is, high in trait disgust – is associated with greater ingroup affiliation (operationalized as increased ethnocentrism), which in turn leads to bolstering the values of the ingroup (operationalized as increased condemnation of moral violations). Thus, ethnocentrism may mediate the relationship between trait disgust and moral condemnation.

The Current Studies

In summary, there are still relatively few published studies of trait disgust and condemnation of non-purity transgressions (Chapman & Anderson, 2014; Jones & Fitness, 2008) and studies that control for potential confounds (e.g. trait anger, conservatism) are especially rare. We therefore first present a meta-analysis of six studies from our lab that have investigated the relationship between trait disgust and condemnation of non-purity transgressions. The meta-analysis also allowed us to investigate whether certain subtypes of trait disgust might be more or less strongly associated with condemnation of non-purity transgressions. Our measure of trait disgust was the widely-used Disgust Scale-Revised (DS-R; Olatunji et al., 2007), which has reliable subscales related to pathogens (e.g. vomit, insects; known as “core” disgust), potentially contaminating stimuli (e.g. toilet seats; known as “contamination” disgust) and body envelope violations (e.g. injuries; known as “animal reminder” disgust). It is not yet clear whether particular subtypes of trait disgust might be differentially associated with condemnation.
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We next describe in detail three of the studies included in the meta-analysis, which tested whether the relationship between trait disgust and harsher condemnation of non-purity transgressions might be mediated by orderliness (Studies 1&2), cognitive thinking style (Studies 1&2), deviance sensitivity (Study 2), generalized social trust (Study 3), or ingroup affiliation (Study 3).

Meta-analysis of Trait Disgust and Moral Condemnation

Method

To confirm and replicate the effect of trait disgust on moral condemnation, as well as to establish what subtype of disgust primarily influences condemnation, we ran an internal meta-analysis on six studies from our lab. This meta-analysis included one published sample (Study 2 from Chapman & Anderson, 2014), two previously unpublished samples, as well as Studies 1 to 3 of the current article. All studies were approved by the Institutional Review Board of the City University of New York.

Participants

In all samples, participants were recruited from MTurk, an online crowdsourcing marketplace (www.mturk.com). Participants were over 18 years of age and restricted to respondents with U.S. IP addresses and a history of 95% acceptable performance on other MTurk studies.

Sample 1. This published sample (Study 2 from Chapman & Anderson, 2014) consisted of 292 participants (139 female, 1 other gender identity), who ranged from 18 to 72 in age (M=31.96, SD=10.58).

Sample 2. This previously unpublished sample included 175 participants (114 female, 1 other gender identity), whose age ranged from 19 to 73 years (M=37.85, SD=13.01).
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Sample 3. This previously unpublished sample consisted of 126 participants (46 female) whose ages ranged from 20 to 66 years (M=34.06, SD=9.16).

Study 1 Sample. This previously unpublished sample consisted of 124 participants (54 female) whose ages ranged from 19 to 66 years (M=34.23, SD=11.26). This study is described in detail below.

Study 2 Sample. This previously unpublished sample consisted of 195 participants (84 female, 2 other gender identity), who ranged from 18 to 69 years in age (M=34.93, SD=10.15). This study is also described in detail below.

Study 3 Sample. This previously unpublished sample consisted of 170 participants (70 female, 1 other gender identity), who ranged from 19 to 64 years of age (M=36.39, SD=9.93). This study is also described in detail below.

Materials

Trait disgust. All participants completed the Disgust Scale–Revised (DS-R; Olatunji et al., 2007). The DS-R is a 25-item revision of the DS (Haidt et al., 1994), and consists of three subscales: core disgust (rotting foods, body products and rodents/insects), animal reminder disgust (blood, gore, death) and contamination disgust (hygiene violations). In Sample 3 participants also completed the Three Domain Disgust scale (TDDS; Tybur et al., 2009), but because this measure was not included in the other samples, it was excluded from the meta-analysis.

Moral condemnation. To measure condemnation, participants evaluated scenarios in which an agent physically or psychologically harms a victim (eight scenarios in Sample 1, five in Sample 2, and six in samples in Studies 1 to 3; see Supplementary Online material for scenarios). We chose to focus on harm transgressions since they are seen as maximally distinct from purity
transgressions (Cameron et al., 2015). The harm scenarios were set in a high school: for example, “A female student slaps another girl in the face” (from Chapman & Anderson, 2014). The scenarios were relatively mild in physical violence, and therefore unlikely to present strong reminders of core or animal reminder disgust stimuli (e.g. bodily fluids, blood, injury). Participants rated the wrongness of the agent’s behavior on a 1 to 9 scale in Samples 1-2 and on a 1 to 7 scale in Sample 3 and samples in Studies 1 to 3 (not at all wrong to extremely wrong), and the ratings were averaged across scenarios to form a condemnation score that served as the main dependent variable.

**Covariates.** Since trait disgust correlates with social conservatism (see Terrizzi et al., 2013 for a meta-analysis), general negative affect (e.g. Haidt et al., 1994; Olatunji, Haidt, McKay, & David, 2008), and gender (Olatunji et al., 2008), we controlled for these variables in all samples. Additionally, because of the close association between moral disgust and anger (Russell & Giner-Sorolla, 2013), we controlled for trait anger in all samples.¹ To measure trait anger, participants completed the Trait scale of the Spielberger State-Trait Anger Expression Inventory (STAXI-T; Spielberger, 1988) in Samples 1-2 and the Anger subscale from the Buss-Perry Aggression Questionnaire (AQ; Buss & Perry, 1992) in Sample 3, and samples in Studies 1 to 3. To measure general negative affect, participants completed the Multidimensional Anxiety Questionnaire (MAQ; Reynolds, 2003) in Samples 1-2 and the Neuroticism subscale of the Big Five Aspects scale (BFAS; DeYoung et al., 2007) in Sample 3, and samples in Studies 1 to 3. In Samples 1-2 social conservatism was measured with the Henningham Social Conservatism Scale (SC; Henningham, 1996), and in Sample 3 and samples in Studies 1 to 3, conservatism was

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¹ An anonymous reviewer suggested that trait anger and social conservatism could be potential mediators, since theoretically they could be linked to trait disgust and condemnation. However, we found no evidence of mediation for trait anger (Study 1: 95% CI [-.03, .20]; Study 2: 95% CI [-.00, .01]) or social conservatism (Study 1: 95% CI [-.01, .17]; Study 2: 95% CI [-.01, .01]).
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measured with single self-report item (“when it comes to social issues, I typically consider myself…” 1=extremely liberal to 7=extremely conservative).

Procedure and data analysis. In all six samples participants first gave informed consent, then judged the wrongness of the harm scenarios and completed the study questionnaires online. Finally, participants were debriefed and compensated. For each sample, a multiple regression was performed with the DS-R subscales and the covariates as predictors for moral condemnation. The standardized regression coefficient Beta constitutes as the unique effect of each type of disgust on condemnation and was used as effect size in the meta-analysis. Because the participants in our samples were diverse in age and location in the United States, a random effects model was used. The analysis was carried out using the “Metafor” package available for R (http://www.metafor-project.org).

Results and Discussion

We ran a meta-analysis on six samples to establish the overall effect of trait disgust on moral condemnation, and to test what type of disgust is primarily associated with condemnation of non-purity transgressions. The total score of the DS-R significantly predicted moral condemnation ($\beta=.22$, $SE=.03$, $p<.001$, CI [.16, .28]). Of the subscales of the DS-R, both core disgust ($\beta=.22$, $SE=.04$, $p<.001$, CI [.14, .31]) and contamination disgust ($\beta=.09$, $SE=.04$, $p=.02$, CI [.02, .17]) significantly predicted moral condemnation, though core disgust had the biggest effect size. Animal reminder disgust ($\beta=-.00$, $SE=.04$, $p=.96$, CI [-.07, .07]) did not predict moral condemnation.

The random effects model also allowed us to test homogeneity of the effect sizes between studies. Higgins and Thompson (2002) recommend using the I$^2$-statistic to quantify heterogeneity: it measures variability in effect sizes, correcting for the number of studies.
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included. For the effect of the total DS-R on condemnation the $I^2$-statistic was 0%, indicating that the effect sizes were homogenous between studies, and all observed variability in them is due to sampling error. For the effect of core disgust on condemnation the $I^2$-statistic was 55.47%, and for the effect of contamination disgust the $I^2$-statistic was 37.75%, indicating moderate heterogeneity in effect sizes (Cumming, 2014; Higgins, Thompson, Deeks, & Altman, 2003). In other words, 55.47% and 37.75% of the variability in effect sizes between studies was due to real differences rather than mere sampling error. Thus, it seems that overall the effects of trait disgust on condemnation were similar across studies, but there were some differences specific to core and contamination disgust.

The results suggest that condemnation of non-purity transgressions is associated specifically with disgust towards contaminating physical substances that cue the actual or potential presence of pathogens. Because we used standardized regression coefficients from multiple regressions that already controlled for covariates, the results also demonstrate that trait disgust is associated with condemnation independently of gender, general negative affect, trait anger and social conservatism. These results provide evidence that trait disgust is not only associated with condemnation of physically disgusting transgressions that violate norms of bodily purity (e.g. Haidt & Graham, 2007; Horberg et al., 2009; Rozin et al., 1999; Russell & Giner-Sorolla, 2013), but also with condemnation of harmful transgressions that involve no physical disgust elicitors (Chapman & Anderson, 2013, Jones & Fitness, 2008; Hutcherson & Gross, 2011; Cameron et al., 2015).

**Study 1: Trait disgust, orderliness, intuitive thinking and moral condemnation**

The meta-analysis confirmed previous findings that higher trait disgust is associated with harsher moral condemnation of non-purity transgressions, even when controlling for potential
confounds (Chapman & Anderson, 2013; Jones & Fitness, 2008). It also suggests that this relationship is primarily driven by variation in sensitivity to the presence of pathogens, i.e. core disgust. Therefore, in subsequent studies we focus on results for core disgust. However, the question of why remains: why do individual differences in the tendency to experience disgust influence moral judgments about transgressions that have nothing to do with disgust? In Study 1 we aimed to test two potential mediators for this effect. Specifically, we investigated whether orderliness or intuitive thinking style might mediate the relationship between trait disgust and moral condemnation.

**Method**

We report all measures, all manipulations, any data exclusions, and the sample size determination rule for Studies 1, 2 and 3.

**Participants.** A power analysis using G*power with a medium effect size $f^2$ of .15 ($\beta=.90, \alpha=.05$) suggested a sample size of 130 participants. We aimed to recruit 150 participants, and a total of 148 participants finished the study. Three participants who took less than 7 or more than 35 minutes were excluded (compared to mean completion time of 16.79 minutes), and 21 participants were excluded because they failed an attention check. Thus, the final sample size was 124 (54 female; mean age=34.23, SD=11.26). Seventy-six percent were Caucasian, 8% were African American, 11% were Asian, 0.8% were Native American or Alaskan Native, 0.8% were Native Hawaiian or other Pacific Islander, and 3.2% were of more than one race.

**Questionnaires.** As described in detail above, participants completed the DS-R (Olatunji et al., 2007) as a measure of trait disgust. The average of wrongness ratings on the six harm scenarios was used as a measure of moral condemnation. To rule out the influence of potential confounds, participants completed the anger subscale of the AQ (Buss & Perry, 1992), the
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Neuroticism subscale of the BFAS (DeYoung et al., 2007) and the one-item political orientation measure. Also, given previous evidence that higher trait disgust is associated with lower openness to experience (Druschel & Sherman, 1999; Tybur, Bryan, Lieberman, Hooper, & Merriman, 2011), participants completed the openness subscale of the BFAS (DeYoung et al., 2007). However, openness was not correlated with the DS-R total scale or any of its subscales, so it is not considered further. For exploratory purposes, we included the Intrinsic Religion subscale of the Duke University Religion Index (DRI; Koenig & Büssing, 2010) and the Revised Paranormal Belief Scale (RPBS; Tobacyk, 2004) in Studies 1 and 2. Because correlations with the DRI and RPBS are not relevant to the purpose of the current research, they are not reported here.

Orderliness was measured with the conscientiousness subscale of BFAS (DeYoung et al., 2007), which consists of scales for orderliness (e.g. “I like order”, “I see that rules are observed”) and industriousness (e.g. “I carry out my plans”, “I am easily distracted” (reverse-coded). Industriousness was not correlated with core disgust (Tables S1 and S4) and is not considered further. Analytical vs. intuitive thinking style was assessed using both performance-based and self-report measures. The two performance-based measures were the Cognitive Reflection Test (CRT; Frederick, 2005) and three Base Rate problems (BR; De Neys & Glumicic, 2008, see Supplementary Online Material). However, 85.5% of participants reported having seen the CRT before, which is problematic for its validity, since having encountered the test before makes answering correctly more likely (Chandler, Mueller, & Paolacci, 2014). Therefore, the CRT was not analyzed further. We also included a 10-item version of the Rational-Experiential Inventory (REI; Epstein et al., 1996) to measure self-reported preference for intuitive or analytical thinking. The REI consists of two independent subscales: Faith in
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Intuition (FI) that measures one’s tendency to rely on intuitions, and Need for Cognition (NFC) that measures one’s tendency to rely on analytical thinking.

Procedure. Study 1 was presented online. Participants gave informed consent, judged the wrongness of the harm scenarios (α=.88), completed the CRT and BR, and subsequently completed the rest of the questionnaires in counterbalanced order. Finally, demographic information was collected.

Results and Discussion

Correlations between trait disgust and the potential mediators

Because the meta-analysis indicated that the relationship between trait disgust and condemnation is primarily due to core disgust, we focus on the results for core disgust (the results for contamination disgust correlations differed very little and the mediations not at all; see Table S1 in the supplementary material for results with the full DS-R and other subscales as well as the covariates). First, zero-order correlations were run between all the variables. Table 1 presents the correlations between core disgust, moral condemnation and potential mediators. As predicted, core disgust was associated with orderliness (r=.18, p=.04); this relationship remained significant in a multiple regression that included the covariates (gender, conservatism, trait anger, neuroticism) as predictors (B=.05, SE=.22, β=.19, p=.04; see Table S2 for full model). This suggests that people who tend to be easily disgusted by pathogens are also more orderly, possibly because being orderly is an effective way to counteract disease threat. People higher in trait core disgust could be keener on keeping order as a strategy to avoid being in contact with contaminating substances and animals that lurk in disorderly environments. This interpretation suggests a causal relationship between trait disgust and orderliness, but because the results are correlational, we cannot rule out alternative directions for the effect.
Correlations between core disgust and measures of intuitive/analytical thinking were more mixed (Table 1). Core disgust was associated with the FI subscale of REI \((r=.27, \ p<.01)\), and this relationship remained significant in a multiple regression that included the covariates as predictors \((B=.64, \ SE=.26, \ \beta=.22, \ p=.02; \ \text{see Table S3 for full model})\). Core disgust was not associated with the NFC subscale \((r=-.13, \ p=.14)\). Scores on the BR were calculated as the number of correct (=analytical) answers, so that lower scores indicate more intuitive thinking. Core disgust was not correlated with a more intuitive response tendency in BR \((r=-.10, \ p=.28)\). These results provide tentative evidence that higher trait disgust is associated with self-reported intuitive thinking style. This association between trait disgust and intuitive thinking may reflect the cognitive impenetrability of disgust: disgust is resistant to the influence of analytical processes and may act through intuitive processes (Hinds et al., 2010; Oaten et. al, 2009). This may spill over to a more general intuitive thinking style in other areas. However, the inconsistencies in these results leave open the question of whether higher trait disgust is (negatively) associated with self-reported analytical thinking and performance in tasks that require analytical thinking. To further explore the relationship between trait disgust and thinking style, we tested their relationship again in Study 2.

**Correlations between moral condemnation and the potential mediators**

Table 1 shows zero-order correlations between moral condemnation and potential mediating variables. As predicted, orderliness correlated with harsher moral condemnation \((r=.20, \ p=.03)\). This is consistent with the idea that the construct of orderliness captures not only a preference for physical order, but also a preference for rules, details and routine. It is possible that orderliness not only protects from physical disorder that may host pathogens, but also motivates the individual to follow and to see that others follow rules that protect the ingroup.
This may explain why orderliness is associated with moral condemnation: people who see order and rules as important may also be more condemning of those who act against them. An interesting avenue for future research would be to test whether orderly people are more condemning solely of moral transgressions, or also of other social norm violations.

From the thinking style measures, harsher moral condemnation was associated with more intuitive thinking in BR ($r=-.18$, $p=.04$), but not with the FI or NFC. The association between harsher moral condemnation and poorer performance in the analytical thinking task may indicate that an intuitive thinking style leads to harsher moral condemnation. Someone with an intuitive thinking style may not ponder upon alleviating factors behind the moral transgression, but rather quickly judge it to be wrong. However, because this association was only observed for BR, not the other measures of intuitive thinking, further research is needed to verify it.

### Table 1

*Study 1: Correlations between core disgust, orderliness, intuitive thinking and moral condemnation*

<table>
<thead>
<tr>
<th></th>
<th>DS-R Core</th>
<th>Orderliness</th>
<th>Base Rate</th>
<th>REI NFC</th>
<th>REI FI</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-R Core</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orderliness</td>
<td>.18*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Rate</td>
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<td>.04</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REI NFC</td>
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<td>.22*</td>
<td>.09</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>REI FI</td>
<td>.27**</td>
<td>.06</td>
<td>-.08</td>
<td>.09</td>
<td>-</td>
</tr>
<tr>
<td>Moral Condemnation</td>
<td>.34***</td>
<td>.20*</td>
<td>-.18*</td>
<td>.15</td>
<td>.11</td>
</tr>
</tbody>
</table>

*Note.* $*p < 0.05$, $**p < 0.01$, $***p < 0.001$. 
TRAIT DISGUST AND MORAL CONDEMNATION

Mediation analyses

The regression analyses just described suggest only one candidate mediator: orderliness, which was correlated with both the DS-R and with moral condemnation. We therefore ran a bias-corrected bootstrapped mediation with 1000 resamples to investigate whether orderliness might mediate the relationship between trait core disgust and moral condemnation. All mediation analyses in Studies 1 and 2 were conducted using Andrew Hayes’s PROCESS Macro extension for SPSS (www.processmacro.org). Our hypothesis was not confirmed: orderliness did not mediate this relationship (ab=.01, SE=.01, 95% CI [.00, .03]). This suggests that while higher trait core disgust is associated with greater orderliness, orderliness does not explain the relationship between trait disgust and harsher condemnation. However, it is also possible that the sample size was not large enough to detect a mediated effect (Fritz & MacKinnon, 2007). Therefore, Study 2 again tested whether orderliness would mediate the relationship between trait disgust and moral condemnation, and sought to replicate the observed relationships between trait disgust, moral condemnation and thinking style. We also tested deviance sensitivity as a potential mediator.

Study 2: Trait disgust, deviance sensitivity and moral condemnation

Method

Participants. Fritz and MacKinnon (2007) recommend a sample size of 200 to detect a mediated effect, given small to medium range (B = .26) effect sizes for paths X to M and M to Y. We chose to oversample, aiming to recruit 230 Mturk participants for the study. Fourteen participants were excluded because they took less than 9 or more than 35 minutes to complete the study (compared to the mean completion time of 17.12 minutes), and 19 participants were excluded because they failed an attention check. The final sample size was 195 (84 female, 2
other gender identity; mean age=34.93, SD=10.15). Seventy-eight percent were Caucasian, 9% were African American, 9% were Asian and 4% were of more than one race.

Procedure. Study 2 was presented online. Participants gave informed consent and judged the wrongness of the same six harm scenarios as in Study 1; wrongness ratings were averaged across scenarios to form a moral condemnation score ($\alpha = .88$). To measure deviance sensitivity, we used a shape classification task in which participants made judgments about geometrical shapes (Okimoto & Gromet, 2016). In this task, participants were presented with figures of “perfect” and “imperfect” shapes (Figure 1). Shapes were presented one at a time. For each shape, participants were asked: “Is this a triangle?” (or circle, square, rectangle and oval, depending on which shape was currently shown; 1 = definitely not to 7 = definitely yes). We computed the difference between evaluations of perfect and imperfect shapes as a measure of deviance sensitivity: larger values indicate greater perception of deviance. We chose to use this measure of deviance sensitivity rather than a measure of social deviance perception because a more socially relevant measure could be confounded with trait disgust or moral condemnation. When confronted with a socially deviant target, in addition to perceiving its deviance, the individual would have an affective reaction towards the target (e.g. anger, disgust) and be motivated to approach or avoid it. Affect and motivation toward the target could then be driving any effect we might find, rather than the perception of non-social deviance which is our hypothesized mediator.

Given that most participants in Study 1 had seen the CRT before, we included only the BR (from De Neys, & Glumicic, 2008) and the REI (including NFC and FI subscales; Epstein et al., 1996) as measures of intuitive thinking. Participants also completed the DS-R (Olatunji et al., 2007), the conscientiousness subscale of the BFAS (DeYoung et al., 2007) to measure
orderliness, as well as the AQ (Buss & Perry, 1992), neuroticism subscale of the BFAS (DeYoung et al., 2007), DRI (Koenig, & Büssing, 2010), RPBS (Tobacyk, 2004), and the one-item political orientation measure. Participants completed all the questionnaires in counterbalanced order. Finally, demographic information was collected.

![Figure 1](image-url)  
*Figure 1. Study 2: Shape stimuli (Okimoto & Gromet, 2016).*

**Results and Discussion**

**Correlations between trait disgust and the potential mediators**

As in Study 1, we chose to focus on the core disgust subscale of the DS-R. First, zero-order correlations were run between all the variables (Table 2; see Table S4 for results with the full DS-R and other subscales as well as the covariates). Replicating Study 1, core disgust correlated with orderliness \( (r=.32, p<.001) \), and the FI \( (r=.20, p<.01) \) subscale of the REI; these relationships held when controlling for the covariates (see Tables S5 and S6 for details). Also as
in Study 1, core disgust was not correlated with the BR (r=-.05, p=.48). Unlike in Study 1, core disgust was negatively correlated with the NFC (r=-.16, p=.02) subscale of the REI. However, this relationship was no longer statistically significant in a regression analysis that also included the covariates as predictors of NFC (Table S7), indicating that core disgust does not predict unique variance in NFC.

Contrary to our hypothesis, core disgust was *negatively* associated with deviance sensitivity (r=-.16, p=.03), in that people higher in trait disgust were *less* sensitive to deviance. In other words, those higher in trait disgust judged that “imperfect” shapes were better examples of shape prototypes. This relationship remained statistically significant in a regression that also included the covariates as predictors (B=-.08, SE=.04, β=-.17, p=.03; see Table S8 for full model). However, an exploratory regression analysis with trait core disgust and orderliness as predictors for deviance sensitivity revealed that the relationship was driven by orderliness (B=-.03, SE=.01, β=-.16, p=.03) rather than core disgust (B=-.50, SE=.04, β=-.11, p=.15). In other words, higher orderliness was associated with lower sensitivity to deviance, which was no longer associated with trait disgust when orderliness was controlled for. A mediation analysis confirmed that the link between trait core disgust and deviance sensitivity was explained by orderliness (ab=-.02, SE=.01, 95% CI [-.05, -.00]). The inverse relationship between orderliness and deviance sensitivity has been found previously (Okimoto & Gromet, 2016), and could reflect a motivated search for order or patterns in the deviant shapes. That is, orderly people may be motivated to make sense of the world by identifying meaningful patterns of stimuli (c.f. Zhao, Hahn, & Osherson, 2014). In this light, it is noteworthy that we tested sensitivity to *ambiguously* deviant objects that differ only slightly from perfect or prototypical shapes. The motivation to
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gain a sense of order could predispose orderly people to classify ambiguously deviant objects as members of the group they are slightly deviating from (i.e. prototypical shapes).

We used a non-social measure of deviance sensitivity, but it could be useful to test a socially relevant measure in future studies. Such a measure would need to deal with the aforementioned problems of confounding with affect or motivation. However, a well-designed socially relevant deviance measure could provide more specific information on how sensitivity to social deviance relates to orderliness, trait disgust or moral condemnation.

Correlations between moral condemnation and the potential mediators

Table 2 shows zero-order correlations between moral condemnation and potential mediating variables (see Table S4 for results with the full DS-R and other subscales as well as the covariates). Unlike in Study 1, the correlation between orderliness and moral condemnation did not reach significance, though it was in the same direction ($r=.10$, $p=.17$). As in Study 1, BR scores significantly predicted harsher moral condemnation ($r=-.17$, $p=.02$). For the FI subscale of the REI there was a non-significant trend ($r=.13$, $p=.07$), while the NFC subscale of REI did not predict moral condemnation ($r=-.04$, $p=.62$). These results provide tentative evidence that a more intuitive thinking style is related to harsher moral condemnation; however, because the results were inconsistent between different measures, further studies are needed to verify this relationship.

Contrary to our expectations, deviance sensitivity was negatively associated with moral condemnation ($r=-.15$, $p=.04$), in that people who were less sensitive to deviance condemned the transgressions more. Although we predicted a positive correlation between deviance sensitivity and condemnation, the negative relationship makes sense in light of the correlation between deviance sensitivity and orderliness. Specifically, those high in orderliness tend to be less
sensitive to deviance, and high orderliness is also associated with increased moral condemnation (significantly in Study 1 and non-significantly in the current study). As discussed above, orderliness may be related to condemnation because people who see order and rules as important may also be more condemning of those who act against them.

Table 2

*Study 2: Correlations between core disgust, deviance sensitivity, orderliness, intuitive thinking and moral condemnation.*

<table>
<thead>
<tr>
<th></th>
<th>DS-R Core</th>
<th>Deviance Sensitivity</th>
<th>Orderliness</th>
<th>Base Rate</th>
<th>REI NFC</th>
<th>REI FI</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-R Core</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviance Sensitivity</td>
<td>-.16*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orderliness</td>
<td>.32***</td>
<td>-.20**</td>
<td>-.20</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Rate</td>
<td>-.06</td>
<td>.19**</td>
<td>-.12</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REI NFC</td>
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<td>.08</td>
<td>.00</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>REI FI</td>
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<td>-.23**</td>
<td>-.01</td>
<td>-</td>
</tr>
<tr>
<td>Moral Condemnation</td>
<td>.28***</td>
<td>-.15*</td>
<td>.10</td>
<td>-.17*</td>
<td>-.04</td>
<td>.13</td>
</tr>
</tbody>
</table>

*Note.* *p < 0.05, **p < 0.01, ***p < 0.001.

**Mediation analyses**

Deviance sensitivity was the only variable significantly associated both with trait disgust and moral condemnation, though the relationship between variables was in the opposite direction from that predicted. We therefore ran a bias-corrected bootstrapped mediation analysis with 1000 resamples to investigate whether deviance sensitivity might mediate the relationship between
trait core disgust and moral condemnation. Our hypothesis was not confirmed: deviance sensitivity did not mediate this relationship \((ab=.01, SE=.01, 95\% \text{ CI } [-.00, .02])\).

An exploratory analysis suggested that the relationship between deviance sensitivity and trait disgust may be mediated by orderliness. For this reason, and because Study 1 found a significant association between orderliness and condemnation, we ran a bias-corrected bootstrapped mediation analysis with 1000 resamples to test whether orderliness might mediate the relationship between trait core disgust and condemnation. This hypothesis was not confirmed: orderliness did not mediate this relationship \((ab=.00, SE=.01, 95\% \text{ CI } [-.01, .02])\).

Following a suggestion by an anonymous reviewer, we also ran a pooled mediation analysis with 1000 resamples on the combined samples from Study 1 and Study 2 \((N=319)\), but this analysis yielded identical results \((ab=.01, SE=.01, 95\% \text{ CI } [-.00, .02])\).

Lastly, because FI was correlated with trait disgust, and there was a trend-level association between the FI subscale of REI and moral condemnation (similar to the significant effect in Study 1), we also ran a bias-corrected bootstrapped mediation analysis with 1000 resamples to investigate whether FI might mediate the relationship between trait core disgust and moral condemnation. Our hypothesis was not confirmed: self-reported intuitive thinking did not mediate this relationship \((ab=.01, SE=.01, 95\% \text{ CI } [-.00, .02])\).\(^2\) We also ran a pooled mediation analysis with 1000 resamples on samples from Study 1 and Study 2, but the results were identical \((ab=.00, SE=.01, 95\% \text{ CI } [-.00, .02])\).

\(^2\) Our goal was to explain why there is a relationship between trait disgust and moral judgment. We therefore focused on mediation models. However, an anonymous reviewer suggested that thinking style could also be a potential moderator, insofar as those who are more analytical may regulate their feelings of disgust to a greater extent, thereby reducing the relationship between trait disgust and moral judgment (e.g. Feinberg, Willer, Antonenko, & John, 2012). However, we did not find evidence for significant moderation of the relationship between core disgust and condemnation by REI FI (Study 1: 95\% CI [-.01, .01]; Study 2: 95\% CI [-.00, .01]), REI NFC (Study 1: 95\% CI [-.01, .01]; Study 2: 95\% CI [-.01, .01]), or BR (Study 1: 95\% CI [-.04, .07]; Study 2: 95\% CI [-.04, .05]).
Study 3: Trait disgust, trust, ethnocentrism and moral condemnation

Method

Participants. Following the guidelines by Fritz and MacKinnon (2007), we aimed to recruit 200 Mturk participants for the study. Twelve participants were excluded because they took less than 3 minutes and 5 because they took more than more than 30 minutes to complete the study (compared to the mean completion time of 9.29 minutes), and 20 participants were excluded because they failed an attention check. One participant was excluded because she did not identify as a U.S. citizen. The final sample size was 170 (70 female, 1 other gender identity; mean age=36.39, SD=9.93). Eighty-one percent were Caucasian, 9% were African American, 3.5% were Asian, 0.6% were Native American or Alaskan Native, and 5.3% were of more than one race.

Procedure. Study 3 was presented online. As in Studies 1-2, participants gave informed consent and judged the wrongness of the harm scenarios, which were then averaged to form a condemnation score (α = .89). To measure generalized social trust, we used the 4-item SOEP-trust measure (Naef & Schupp, 2009, α = .89), which measures one’s trust in people one does not know. Example items include “In general, you can trust people” and “When dealing with strangers, it’s better to be cautious before trusting them”, from 1=disagree strongly to 4=agree strongly). To measure ingroup affiliation, we used the American Ethnocentrism scale (Neuliep & McCroskey, 1997, α = .94), with items such as “Life in the United States is much better than in most places” and “Most other countries are backward compared to the United States). We also included a question about identifying as a U.S. citizen to exclude people who may not consider U.S. citizens as their ingroup. Participants also completed the DS-R (Olatunji et al., 2007), the AQ (Buss & Perry, 1992), neuroticism subscale of the BFAS (DeYoung et al., 2007), and the
one-item political orientation measure. Participants completed all the questionnaires in counterbalanced order. Finally, demographic information was collected.

**Results and Discussion**

*Correlations between trait disgust, trust and ethnocentrism*

As in Studies 1-2, we chose to focus on the core disgust subscale of the DS-R. First, zero-order correlations were run between all the variables (Table 3; see Table S9 for results with the full DS-R and other subscales as well as the covariates). Replicating past research (Aarøe et al., 2016), trait disgust was negatively correlated with trust (r=-.16, p<.05), but this relationship fell below significance when covariates were controlled for, suggesting that the relationship may ultimately be explained by neuroticism, conservatism or trait anger (Table S10). Past findings suggest that trait disgust may be associated with lower trust, because being in close contact with a large circle of people makes one susceptible to pathogens (Aarøe et al., 2016). However, the current study casts doubt on these findings by suggesting that third variables may ultimately explain the relationship between trait disgust and trust. Further studies are needed to conclusively answer this question. Trait disgust was not significantly correlated with ethnocentrism (r=.05, p=.49). This is in contrast with past studies suggesting that transitory or chronic vigilance to disease threat binds people to their ingroup since ingroup members are the ones most likely to provide help if one becomes sick (Navarrete & Fessler, 2006; 2007).

*Correlations between condemnation, trust and ethnocentrism*

Table 3 shows zero-order correlations between moral condemnation and potential mediating variables. Neither trust (r=.004, p=.96) nor ethnocentrism (r=.08, p=.28) were related to moral condemnation. Because neither trust nor ethnocentrism were correlated with both trait
disgust and condemnation, neither was a potential mediator of the relationship between trait disgust and condemnation.

Table 3

*Study 3: Correlations between core disgust, trust, ethnocentrism and moral condemnation.*

<table>
<thead>
<tr>
<th></th>
<th>DS-R Core</th>
<th>Trust</th>
<th>Ethnocentrism</th>
<th>Moral condemnation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-R Core</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td>-.16*</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnocentrism</td>
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<td>.06</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Moral condemnation</td>
<td>.16*</td>
<td>.00</td>
<td>.08</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note. *p < 0.05, **p < 0.01, ***p < 0.001.*

**General Discussion**

Our goal in this research was to shed light on the relationship between trait disgust and condemnation of non-purity transgressions. We first presented a meta-analysis (N=1082) replicating previous results, namely that the trait disgust—condemnation link is not due to confounds including trait anger, general negative affect, gender or social conservatism (Chapman & Anderson, 2014; Jones & Fitness, 2008). This provides evidence that trait disgust is not only associated with condemnation of transgressions that violate norms of bodily purity (Haidt & Graham, 2007; Horberg et al., 2009; Rozin et al., 1999; Russell & Giner-Sorolla, 2013), but also with condemnation of harmful transgressions that involve no physical disgust elicitors (Chapman & Anderson, 2013; Jones & Fitness, 2008; Hutcherson & Gross, 2011; Cameron et al., 2015). Further, we found that the relationship between higher trait disgust and harsher condemnation
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was primarily explained by disgust towards common pathogen-bearing substances such as body products, spoiled food, rodents and insects (i.e. core disgust). This suggests that harshly condemning harmful moral transgressions that do not involve physical disgust elicitors, is associated specifically with disgust toward the very physical disgust elicitors that those transgressions lack. Disgust toward body envelope violations and death (i.e. animal reminder disgust) was not associated with harsher condemnation. This suggests that contrary to what some have argued (Tybur et al., 2009), such disgust is distinct from ‘core’ or ‘pathogen’ disgust, because it relates differently to other variables. Further, our studies provide support for the view of disgust as an input, rather than an output of moral decision making. If disgust was the output of moral decision making, we should see all types of disgust equally relating to condemnation. Since the moral transgressions contain no disgust elicitors specific to either of these disgust types, these types should not differ in their relation to condemnation. However, we find that condemnation primarily relates to core disgust, and not at all to animal reminder disgust, suggesting that sensitivity to pathogens and contaminating substances – but not to injuries or body envelope violations – serves as an input to moral decision making.

To explain why this would be the case, we hypothesized that orderliness, deviance sensitivity, thinking style, generalized social trust, or ethnocentrism might mediate the effect of trait disgust on moral condemnation. Theoretically, development of basic emotional processes (i.e. disgust) should precede the development of personality traits (i.e. orderliness) and more complex cognitive and social processes such as deviance sensitivity, thinking style, generalized social trust, and ingroup affiliation, and all should precede conscious moral judgment. Hence, we proposed these cognitive, social and personality variables as potential mediators for the association between trait disgust and condemnation.
In this research we found evidence that trait core disgust is associated with higher orderliness and lower sensitivity to deviance, though the latter was ultimately explained by orderliness. Trait core disgust was also associated with a self-reported preference for intuitive thinking in both studies, but not with preference for analytical thinking or performance in an analytical thinking task. Trait disgust was associated with lower trust, though this relationship fell below significance when gender, neuroticism, conservatism and trait anger were controlled for. Trait disgust was not associated with ethnocentrism. Orderliness, deviance sensitivity, and preference for intuitive thinking were associated with moral condemnation (albeit with some inconsistency across Studies 1 and 2), while trust and ethnocentrism were not. However, none of these variables mediated the relationship between trait core disgust and condemnation. Thus, we found no answer to the question of why higher trait disgust is associated with harsher condemnation of non-purity transgressions.

Even though the studies did not explain the link between trait disgust and condemnation, they do paint a clearer picture of the cognitive and personality correlates of trait disgust. Specifically, they portray the disgust sensitive individual as someone who strictly condemns causing harm, relies on their intuitions, prefers order and rules, tends toward inclusive classification of deviant objects, and is wary of trusting others. Overall, trait disgust seems to cluster with traits that form a rather rigid or “judgmental” personality. The characteristics clustering around disgust – keeping physical and social order and quickly judging new things and people who threaten this order – may relate to trait disgust because they are useful in protecting the individual from the dangers of the microbial world.

Another interesting finding from our studies is that people who see order and rules as important are less sensitive to deviance when categorizing non-prototypical objects (see also
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Okimoto & Gromet, 2016). Sensitivity to deviance is a relatively new construct, but it could be related to the tendency to perceive order or patterns in ambiguous stimuli (Whitson & Galinsky, 2008). If this is true, then decreased sensitivity to deviance may reflect an increased perception of order. People who are high in trait orderliness may be motivated to search for order in ambiguity, which could result in inclusive classification of slightly deviant targets, explaining their decreased sensitivity to deviance. This interpretation could be tested by examining the relationships between deviance sensitivity, orderliness and measures of the tendency to perceive patterns in random stimuli or events, such as visual static noise (Whitson & Galinsky, 2008), abstract art or coin tosses (van Prooijen, Douglas, & De Inocencio, 2017).

Another characteristic that has been associated with a motivated search for order is social conservatism (Jost, Glaser, Kruglanski, & Sulloway, 2003). However, we found that the link between orderliness and reduced deviance sensitivity persisted when controlling for social conservatism (B=-.03, SE=.01, β=-.21, p=.01), suggesting that there is something unique in orderliness that is linked to searching for order in ambiguity, with implications for moral judgment across the political spectrum. Interestingly, harsher moral condemnation was also associated with reduced deviance perception. The tendency to judge moral transgressions harshly may be part of the rigid or judgmental personality encompassing high trait disgust, intuitive thinking, high orderliness and a motivated search for order.

An interesting possibility is that individuals to whom order and rules are important see disorder as a threat, and attempt to regain order by condemning the cause of this disorder. Past work has shown that threatening the sense of control triggers various mechanisms of compensatory control, for instance belief in higher powers such as God or the government (Kay, Gaucher, Napier, Callan, & Laurin, 2008), a preference for scientific stage theories over
continuum theories (Rutjens, van Harreveld, van der Pligt, Kreemers, & Noordewier, 2013) and a preference for orderly presentations of a chaotic process such as evolution (Rutjens, Van Der Pligt, & van Harreveld, 2010). It is possible that a similar mechanism is at work in the associations between orderliness, reduced deviance sensitivity and moral condemnation. Orderly people may experience moral transgressions as a threat to order, and use greater condemnation as a buffer against this threat. Future studies could test this idea by examining whether manipulating the magnitude of disorder amplifies moral judgment, and whether any such amplification is moderated by trait orderliness.

One limitation of our studies worth noting is acquiescence bias, that is, the tendency to respond by choosing options only on one end of the scale (Watson, 1992). Because both the Disgust Scale-Revised and the moral condemnation items were coded in the same direction, some participants might have been compelled to agree with the statements of both scales. However, while all the commonly used trait disgust measures (DS; Haidt et al., 1994, DS-R; Olatunji et al., 2007, TDDS; Tybur et al., 2009, DPSS; Van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006, Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007) have a shortage of reverse-coded items, they have been appropriately validated and predict behavioral disgust responses (e.g. Deacon & Olatunji, 2007; Fan & Olatunji, 2013; Olatunji, Ebesutani, Haidt, & Sawchuk, 2014), suggesting that they adequately measure disgust as a stable trait. As for moral condemnation, future studies might employ behavioral measures instead of questionnaires to circumvent this problem.

To summarize, we found that higher trait disgust, in particular its core aspect, is reliably associated with harsher condemnation of non-purity transgressions independently of gender, general negative affect, trait anger and social conservatism. This finding runs contrary to the idea
that disgust’s role in moral judgment is restricted to the purity domain (Haidt & Graham, 2007; Horberg et al., 2009; Rozin, et al., 1999; Russell & Giner-Sorolla, 2013), pointing instead to a broader role for disgust in many areas of morality (Chapman & Anderson, 2013; Jones & Fitness, 2008; Hutcherson & Gross, 2011; Cameron et al., 2015). Although we did not find an explanation for why trait core disgust is related to increased condemnation of non-purity transgressions, the studies open new avenues for research by shedding light on the cognitive and personality correlates of trait disgust and moral condemnation. They provide evidence that trait disgust is associated with orderliness and an intuitive thinking style, and suggestive evidence that harsher moral condemnation is associated with an intuitive thinking style, orderliness and reduced sensitivity to deviance. Additional research will be needed to fully understand the relationship between trait disgust and moral condemnation.
References


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Supplementary Online Materials

The purpose of the supplementary material is to ensure transparency of conducted analyses and used materials.


Scenarios in Sample 1:

A student jumps to the front of the line ahead of other student in the cafeteria.
One student tells all her friends about a secret that another student told her.
In gym class, a student throws a basketball at the back of another student's head, hitting him.
A student puts out her foot and trips up another student who is running down the hall.
One student pushes another student, who falls to the ground.
One student laughs at another student who failed a math test, saying that he must be stupid.
After school, a student throws a hard, icy snowball in another student's face.
A female student slaps another girl in the face.

Scenarios in Sample 2:

In gym class, a student throws a basketball at the back of another student's head, hitting him.
One student pushes another student, who falls to the ground.
One student laughs at another student who failed a math test, saying that he must be stupid.
After school, a student throws a hard, icy snowball in another student's face.
A female student slaps another girl in the face.

Scenarios in Sample 3 and Samples from Studies 1-3:

In gym class, a student throws a basketball at the back of another student's head, hitting him.
A student puts out her foot and trips up another student who is running down the hall.
One student pushes another student, who falls to the ground.
TRAIT DISGUST AND MORAL CONDEMNATION

One student laughs at another student who failed a math test, saying that he must be stupid.

After school, a student throws a hard, icy snowball in another student's face.

A female student slaps another girl in the face.

**Base rate problems (from De Neys, & Glumicic, 2008)**

In a study, 1000 people were tested. Among the participants there were 997 nurses and 3 doctors. Paul is a randomly chosen participant of this study. Paul is 34 years old. He lives in a beautiful home in a posh suburb. He is well spoken and very interested in politics. He invests a lot of time in his career.

What is most likely?

- Paul is a nurse.
- Paul is a doctor.

In a study, 1000 people were tested. Among the participants there were 4 men and 996 women. Jo is a randomly chosen participant of this study. Jo is 23 years old and is finishing a degree in engineering. On Friday nights, Jo likes to go out cruising with friends while listening to loud music and drinking beer.

What is most likely?

- Jo is a man.
- Jo is a woman.

In a study, 1000 people were tested. Among the participants there were 5 sixteen-year olds and 995 fifty-year olds. Ellen is a randomly chosen participant of this study. Ellen likes to listen to hip hop and rap music. She enjoys wearing tight shirts and jeans. She’s fond of dancing and has a small nose piercing.

What is most likely?

- Ellen is sixteen.
- Ellen is fifty.
### Study 1: Correlations between trait disgust, orderliness, intuitive thinking, moral condemnation and covariates (N=124).

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*Note. *p < 0.05, **p < 0.01, ***p < 0.001.
# TRAIT DISGUST AND MORAL CONDEMNATION

Table S2.

*Study 1: Regression with DSR-Core and covariates as predictors for orderliness (N=124)*

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<td>$F$</td>
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*Note. *p < 0.05, **p < 0.01, ***p < 0.001.*
Discussion of the Table

Table S3.

*Study 1: Regression with DSR-Core and covariates as predictors for the FI subscale of the REI (N=124)*

<table>
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<th>β</th>
<th>p</th>
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$R^2$  \hspace{1cm} .40

$F$  \hspace{1cm} 4.41***

*Note. *p < 0.05, **p < 0.01, ***p < 0.001.*
Table S4. Study 2: Correlations between trait disgust, orderliness, intuitive thinking, deviance sensitivity, moral condemnation and covariates (N=195).

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<td>13 Social conservatism</td>
<td>.19*</td>
<td>.14*</td>
<td>.15*</td>
<td>.22**</td>
<td>.29**</td>
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*Note. *p < 0.05, **p < 0.01, ***p < 0.001.
### Table S5.

*Study 2: Regression with DSR-Core and covariates as predictors for orderliness (N=195)*

<table>
<thead>
<tr>
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<td>Gender</td>
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<td>$R^2$</td>
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<td>$F$</td>
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*Note.* *p < 0.05, **p < 0.01, ***p < 0.001.
Table S6.

*Study 2: Regression with DSR-Core and covariates as predictors for the FI subscale of the REI (N=195)*

<table>
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<th>β</th>
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<td>.31</td>
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<tr>
<td>Trait Anger</td>
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<td>.23*</td>
<td>.09</td>
<td>.24</td>
<td>.01</td>
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<td>-.06</td>
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<td>.19</td>
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<td>Gender</td>
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\[ R^2 = .31 \]

\[ F = 4.00** \]

*Note. *p < 0.05, **p < 0.01, ***p < 0.001.*
**Table S7.**

*Study 2: Regression with DSR-Core and covariates as predictors for the NFC subscale of the REI (N=195)*

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*$R^2 = .14$

*$F = 5.89***$

*Note. *p* < 0.05, **p* < 0.01, ***p* < 0.001.*
Table S8.

*Study 2: Regression with DSR-Core and covariates as predictors for deviance sensitivity (N=195)*

<table>
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<td>.03</td>
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\[ R^2 \quad .22 \]

\[ F \quad 1.90 \]

*Note. *p < 0.05, **p < 0.01, ***p < 0.001.*
Table S9.

Study 3: Correlations between trait disgust, trust, ethnocentrism, moral condemnation and covariates (N=170).

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<th>8</th>
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<th>10</th>
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<td>.16*</td>
<td>.15*</td>
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<td>.08</td>
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<td>.27***</td>
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Note. *p < 0.05, **p < 0.01, ***p < 0.001.
Table S10.

**Study 3: Regression with DSR-Core and covariates as predictors for trust (N=170)**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Trust</th>
<th>SE B</th>
<th>β</th>
<th>p</th>
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</thead>
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*Note. *p < 0.05, **p < 0.01, ***p < 0.001.*